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ENGINEERING DESIGN FILE

Project/Task Model of Migration of Hazardous Constituents  
Subtask Flooding Events

EDF Page 1 of 2

Subject ESTIMATE OF WATER IN PITS DURING FLOODING EVENTS

Abstract

There have been three known major flooding events at the Radioactive Waste Management Complex (RWMC). These events occurred in 1962, 1969, and 1982. An estimate of the amount of water that flooded the Subsurface Disposal Area (SDA) during the three events is necessary for the development of certain elements of the model being developed to predict the migration of radioactive and chemical contaminants through the subsurface environment beneath the RWMC.

The volume of water for the flooding events of 1962 and 1969 were estimated based on volumes of the pits opened for those respective dates. The pits that were opened during those time periods were partially filled with waste. The approximate volume of waste was summed up to the flood date for pits 2, 3, 8, 9 and 10 using Radioactive Waste Management Information System (RWMIS) data. The difference between the volume of waste in the pits at the time of the flood and the total excavated volume will approximate the amount of water within the given pit during the flood.

The flooding event of 1982 was reported in detail in Engineering Design File number 103, "Failure of a Dike and Entry of Runoff Water into the RWMC SDA - 1982," Rev. 1. It was in this report that an approximate amount of water in the southeast corner of the SDA was found.

It should be noted that the volume calculations for the 1962 and 1969 pits include an assumed 30% disposal efficiency (waste volume/excavated volume). The assumption is based on a 27-33% range cited in Reference No. 1, Quantity of Contaminated Soil, which is attached.

SUMMARY

1962	$8.9 \times 10^6$	gallons of water
1969	$11.4 \times 10^6$	
1982	$2.7 \times 10^6$	
	<hr/>	
	$23.0 \times 10^6$	gallons of water

Distribution (complete package)

R. G. Baca, C. J. Bonzon, R. L. Devries, T. L. Rasmussen, S. A. Morreale

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Author M. J. Vignil Dept. 7900

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Approved C. J. Bonzon Date 5/27/88

ENGINEERING DESIGN FILE

Project/Task Model of Migration of Hazardous Constituents  
Subtask Flooding Events

EDF Page 2 of 2

Subject ESTIMATE OF WATER IN PITS DURING FLOODING EVENTS

Abstract

The amount of flood water could only be estimated primarily due to several factors:

- 1) Possible inaccuracy of pit volumes (RWMIS).
- 2) SDA pooling due to surface contour was not considered.
- 3) Rate of evaporation was not considered.
- 4) Water in trenches that were opened during that time was not taken into account due to the relative volume difference compared to the pits.

REFERENCES

1. T. G. Humphrey/J. R. Bishoff ltr to T. H. Smith, TGH-3-80, Quantity of Contaminated Soil, May 8, 1980.
2. D. H. Card, History of Buried Transuranic Waste at INEL, EG&G WMP-77-3, March 1977.
3. RWMIS Disposal Date Listing.
4. EDF No. 103, Rev. 1, Failure of a Dike and Entry of Runoff Water into the RWMC SDA-1982, January 18, 1983, R. L. Devries.
5. EDF No. BWP-4, Volume of TRU Waste and TRU Contaminated Soil Subject to BWP Retrieval Operations, March 30, 1988, M. P. Plessinger.

I. 1962 FLOODA. PIT 2

AS OF 2-2-62 (RWMIS)  $\Rightarrow$  7,288 m<sup>3</sup> WASTE  
DISPOSED

$$\frac{\text{WASTE VOLUME (WV)}}{\text{EXCAVATED VOLUME (EV)}} = 0.30 \Rightarrow EV = \frac{WV}{0.30}$$

$$EV = \frac{7,288}{0.30} = 24,293 \text{ m}^3 \text{ WASTE \& CONTAMINATED SOIL (AS OF 2-2-62)}$$

$$\text{TOTAL EXCAVATED VOLUME}^* = 47,694 \text{ m}^3$$

$$\text{DIFFERENCE} = 47,694 - 24,293 = 23,401 \text{ m}^3$$

$$23,401 \text{ m}^3 \left( \frac{264.17 \text{ GAL}}{\text{m}^3} \right) = \underline{6,181,842 \text{ GALLONS}}$$

B. PIT 3

AS OF 2-2-62 (RWMIS)  $\Rightarrow$  933 m<sup>3</sup> WASTE DISPOSED

$$\text{EXCAVATED VOLUME} = \frac{933}{0.3} = 3,110 \text{ m}^3 \text{ WASTE \& SOIL (AS OF 2-2-62)}$$

$$\text{TOTAL EXCAVATED VOLUME} = 13,376 \text{ m}^3$$

$$\text{DIFFERENCE} = 13,376 - 3,110 = 10,266 \text{ m}^3$$

$$10,266 \text{ m}^3 \left( \frac{264.17 \text{ GAL}}{\text{m}^3} \right) = \underline{2,711,969 \text{ GALLONS}}$$

$$\text{PIT 2} + \text{PIT 3} = 6,181,842 + 2,711,969 \text{ GALLONS}$$

$$\underline{\underline{= 8.9 \times 10^6 \text{ GALLONS H}_2\text{O} \leftarrow}}$$

\* REFERENCE NO. 5

## II. 1969 FLOOD

### A. PIT 8

AS OF 12-04-68 (RWMIS)  $\Rightarrow$  398 M<sup>3</sup> WASTE DISPOSED

$$\text{EXCAVATED VOLUME} = \frac{398}{0.3} = 1,327 \text{ M}^3$$

$$\text{TOTAL EXCAVATED VOLUME} = 11,025 \text{ M}^3$$

$$\text{DIFFERENCE} = 11,025 - 1,327 = 9,698 \text{ M}^3$$

$$9,698 \text{ M}^3 \left( \frac{264.17 \text{ GAL}}{\text{M}^3} \right) = \underline{2,561,921 \text{ GALLONS}}$$

### B. PIT 9

AS OF 10-18-68 (RWMIS)  $\Rightarrow$  4,168 M<sup>3</sup> WASTE DISPOSED

$$\text{EXCAVATED VOLUME} = \frac{4,168}{0.3} = 13,893 \text{ M}^3$$

$$\text{TOTAL EXCAVATED VOLUME} = 14,546 \text{ M}^3$$

$$\text{DIFFERENCE} = 14,546 - 13,893 = 653 \text{ M}^3$$

$$653 \text{ M}^3 \left( \frac{264.17 \text{ GAL}}{\text{M}^3} \right) = \underline{172,503 \text{ GALLONS}}$$

### C. PIT 10

AS OF 12-31-68 (RWMIS)  $\Rightarrow$  2,582 M<sup>3</sup> WASTE

$$\text{EXCAVATED VOLUME} = \frac{2,582}{0.3} = 8,607 \text{ M}^3$$

$$\text{TOTAL EXCAVATED VOLUME} = 41,240 \text{ M}^3$$

$$\text{DIFFERENCE} = 41,240 - 8,607 = 32,633 \text{ M}^3$$

$$32,633 \text{ M}^3 \left( \frac{264.17 \text{ GAL}}{\text{M}^3} \right) = \underline{8,620,660 \text{ GALLONS}}$$

## II. 1969 FLOOD (CONTINUED)

$$\text{PIT 8} + \text{PIT 9} + \text{PIT 10} \approx \underline{\underline{11.4 \times 10^6}} \text{ GALLONS H}_2\text{O} \leftarrow$$

III. 1982 FLOOD

FROM REFERENCE NO. 4

$$\Rightarrow \underline{\underline{2.7 \times 10^6}} \text{ GALLONS H}_2\text{O} \leftarrow$$



FORM EG&amp;G-2631 (Rev. 4-78)

## ENGINEERING DESIGN FILE

PROJECT FILE NO. \_\_\_\_\_

EDF SERIAL NO. 103, Revision 1

FUNCTIONAL FILE NO. \_\_\_\_\_

DATE January 18, 1983PROJECT/TASK Radioactive Waste Management ComplexSUBTASK Subsurface Disposal Area (SDA)EDF PAGE NO. 1 OF 31

SUBJECT FAILURE OF A DIKE AND ENTRY OF RUNOFF WATER INTO THE RWMC  
SDA - 1982

This report documents the sequence of events that resulted in run-off water entering the Radioactive Waste Management Complex (RWMC) Subsurface Disposal Area (SDA). This report also documents the corrective actions that were taken to mitigate the consequences of this water entering the SDA. The corrective actions included steps to preclude further entry of run-off water into the SDA, removal of the water that entered the SDA, and sampling of the water in and around the RWMC to verify that established guidelines and limits were not exceeded.

On the morning of February 17, 1982, during an inspection of the RWMC SDA, a break was found in the southeast corner of the dike that surrounds the RWMC SDA. This break allowed run-off water to enter the SDA and eventually Pit 16. Further investigation revealed that the culverts in the southeast SDA drainage channel were blocked by ice and snow. The dike was repaired on February 17, 1982, and the blocked culverts were removed so that further drainage would not be inhibited. Pumps were placed into Pit 16, and the accumulated run-off water was pumped into the RWMC surface water drainage system. Samples of the pump discharge water were taken several times per day. These samples were analyzed to determine the gross activity in the water and the isotope content and concentration in the water. Figure 1 shows the sampling points within the RWMC.

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AUTHOR	DEPT.	REVIEWED	DATE	APPROVED	DATE
R. L. Devries	7440	<i>R. M. Brown</i>	1-19-83	<i>K. P. Lange</i>	1-21-83

The accumulated run-off water was removed from the SDA by pumping and percolation. The water sample results indicate that limits for release to an uncontrolled area were not exceeded.

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#### DISCUSSION AND CHRONOLOGY OF EVENTS

The last week of January a meeting was held to discuss contingency plans to mitigate the consequences of a rapid snow melt resulting in excess run-off water. This meeting was held because of the conditions that existed at the time, i.e., frozen ground covered by an above average snowpack. As a result of this meeting, courses of action had been rehearsed should a rapid thaw occur. Equipment utilization was set up and a personnel alert schedule was established. During the normal work day, RWMC personnel would monitor snow melt and run-off rate. During the off shifts, the security guard would be utilized to monitor the run-off rate. If a problem situation developed, the RWMC Supervisor or the RWMC Operations Branch Manager would be notified.

The equipment utilization plan included using the crawler tractor. Since this piece of equipment was out of service, it was planned that the large front-end loader (Trojan) would be used instead, and if necessary, the landfill crawler tractor could be used.

During the three day weekend and holiday commencing February 12, 1982, a rapid warming trend occurred, accompanied by strong winds and rain. The warm temperatures, wind, and rain accelerated the thawing of the snowpack; however, the snowpack retained most of the water. The RWMC security guard was contacted several times during this period. Each time he reported that little run-off had occurred. RWMC personnel were on standby during this period, but their services were not required.

On Tuesday morning (2-16-82), an inspection of the RWMC revealed that the run-off was increasing. Based on the increased run-off and a long-range weather forecast for continued warm weather, the RWMC equipment was dispatched to clear the drainage channels. Although many snow drifts were removed from the SDA prior to the thawing conditions, no drainage channels were plowed. These channels were not plowed because past experience has shown that this promotes further drifting. It also contributes to partial thawing and refreezing resulting in ice buildup. All work proceeded according to the contingency plan that had been previously rehearsed. The Trojan (replacing the crawler tractor) cleared a two-mile length of the RWMC drainage channel that runs north of the RWMC (see Figure 2). The Trojan was then assigned to clear the drainage channels that surround the SDA (see Figure 1). The backhoe (Drott) was used to open all culverts and narrow channels. The road grader (Champion) was used to open the run-off channels around most of the RWMC buildings.

The warm winds continued and by mid-afternoon the water run-off was noticeably increasing. The snow drifts were over-saturated with moisture and were draining heavily. The first unplanned event occurred at this time. The Trojan was clearing the drainage channel south of WMF-602 (see Figure 1) when it became stuck. Although this did not significantly interfere with the water flow through the channel, removing the stuck Trojan required the use of additional equipment and many manhours.

By the end of the normal work day (2-16-82), run-off water had surrounded the outside of the SDA dike system. Run-off was also up to, but not entering, several of the RWMC administrative buildings. No water had accumulated in Pit 16; however, due to snow melt from within the area, some water had started accumulating (ponding) in the covered trench areas of the SDA. The primary ponding was in the southeast portion of the SDA. Most of the RWMC operations personnel were held over to complete recovery of the Trojan and to verify that all drainage channels were flowing properly. At about 2000 hours, it appeared that the water level had crested and was

falling. All RWMC drainage channels were flowing smoothly, and conditions were stable. Following a final inspection at 2015 hours, all RWMC operations personnel departed.

When RWMC personnel arrived the next morning (2-17-82), it appeared that the run-off problem was well under control. The run-off water had receded away from the RWMC administrative buildings; however, upon inspection of the SDA, a break was discovered in the dike system that surrounds the SDA (see Figure 1). The break was on the east end of the south side. Run-off water had flowed through the break and into the southeast portion of the SDA and Pit 16. The culverts at the southeast corner of the SDA were blocked with snow and ice. This blockage caused the water level upstream of the culverts to raise and overflow the dike. The overflow cut through the dike, allowing additional run-off water to flow into the SDA.

The dike was immediately repaired, and the flow of run-off water into the SDA was stopped. The blocked culverts were removed, and the drainage channel in this area was opened up to allow maximum flow. EG&G Management and DOE-ID were notified of the occurrence, and plans were initiated to remove the water from the pit area. After the dike was repaired, the SDA was inspected to determine the magnitude of the problem. Two pools of water had formed in Pit 16. The water in the northeast end of Pit 16 was about 18 in. up on the bottom row of plywood waste containers. The water in the south end of Pit 16 was about 4 ft up on the bottom row of 6-ft-high M-III bins. These metal bins are water-tight and they were the only uncovered waste containers stored in the south end of Pit 16.

Contamination of the run-off water that had accumulated in Pit 16 was a major concern in the recovery plan. A water-sampling program was initiated to provide data on the activity in the water in Pit 16, the water within the RWMC, and the water leaving the RWMC. Water samples were taken by three groups: RWMC Health Physics personnel, EG&G Waste Programs (WP)

Environmental Science Section, and DOE Radiological and Environmental Sciences Laboratory (RESL). RESL sampled only the run-off water leaving the RWMC. Figure 1 shows the location of sampling points within the RWMC.

During the recovery operations the alpha/beta proportional counter at the RWMC was used as a means of screening samples. Water samples could be screened easily and quickly to determine trends and to determine which samples required further analysis. A guideline of 20 cpm above background for surface contamination was used. A 10-mL water sample was used since it approximates the area covered during a smear survey, the beta-gamma efficiency of the smear counter is 10 percent, and a 10-mL sample could be prepared quickly. A 20 cpm/10-mL sample represents a beta-gamma concentration of  $9.01\text{E-}6$   $\mu\text{Ci/mL}$ . An extensive review of Department of Energy (DOE) Directive 5480.1 (Reference 1) has revealed that the applicable limit for screening water samples should have been  $3\text{E-}6$   $\mu\text{Ci/mL}$  (6.7 cpm/10-mL). Appendix I of this report contains a discussion of the water-sampling program and the results of the sampling. A review of the gross activity data shows that the limit for screening water samples was exceeded on several occasions. Although the limits used for screening water samples were incorrect, samples analyzed using gamma spectrometry techniques were within the limits for releases to an uncontrolled area<sup>a</sup> when averaged over the pumping period (Reference 1).

The recovery plan that was implemented involved pumping the run-off water out of Pit 16 and into the SDA drainage channels. This would involve pumping about 2.7-million gal. of water.<sup>b</sup> The Central Facilities Area

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a. Because the radium daughter background at ENICO (and the RWMC RAL) is high and variable and one of the intermediate daughters is gaseous, Ra-226 results are unreliable.

b. The Elm Street swimming pool in Idaho Falls contains 300,000 gal.

(CFA) Equipment Pool, Labor Pool, EG&G Fire Engineering, and DOE Fire Department were contacted for pumps. This search for pumping equipment revealed that the INEL is not adequately equipped to handle a large pumping task. An excess fire pump was located at approximately 1400 hours on 2-17-82; however, it was not placed into service until 2-19-82 due to repairs and modifications required to refurbish the pump. At about 1500 hours on 2-17-82, three pumps arrived at the RWMC; one 3-in. and two 2-in. pumps. Both 2-in. pumps failed after less than one day in operation. A 5-in. pump located at Raft River arrived at the RWMC at approximately 2200 hours on 2-17-82. Pumping operations continued on a three shift per day basis.

As the air temperature dropped to near freezing, the run-off rate decreased noticeably. Pumping from the north end of Pit 16 continued, and by Thursday afternoon (2-18-82), the water level was below the plywood boxes of waste. Water in the south end of Pit 16 was not immediately pumped out since the waste containers in contact with the water were metal and were water-tight. Pumping of the water in the north end of Pit 16 continued since one of the primary concerns was drying out of the plywood waste containers that were exposed to standing water. The plywood waste containers sat in water for about 30 hr. Recovery operations continued with pump problems being the most frustrating challenge. The pumps would cease to function; they would be repaired and put back into service only to fail again after a short period of operation.

During the second shift on Friday (2-19-82), contamination (600 cpm) was found on one shoe and one pants cuff of one of the RWMC personnel. It was determined that the contamination came from the northeast side of Pit 16. The area was roped off, and an extensive survey was made to determine whether further spread of contamination had occurred. The SDA traffic areas and the RWMC facilities areas were surveyed, but no contamination was found. A survey of Pit 16 was performed to more clearly define the source

of the contamination and its extent. The source of the contamination was mud that had seeped out from under several plywood boxes that contain contaminated wastes. The areas surveys revealed that the contamination extended out about 2 ft from the stacked plywood boxes and about 14 ft along the stack.

Clean soil was hauled in the next day (2-20-82), and a small dike was formed around the exposed stack of plywood boxes. Several days later more soil was hauled in, and a cover layer of soil 2-ft-thick was spread over the contaminated soil. Unusual Occurrence Report RWMC-82-2 (Reference 2) was written documenting the contamination of RWMC personnel clothing.

Saturday (2-20-82) significant pump problems continued. No significant pumping was accomplished until very late in the day. By this time, the warm weather was thawing the ground rapidly, and trench subsidence became a concern. Trench subsidence could be seen in several locations from the SDA roads. Closer examination was not possible because access was restricted to keeping on the established roads within the SDA. Subsidence could be seen in the trenches on the east end of the SDA, the south side of the SDA (Trenches 45, 47, 49, 51, and 53), the Early Waste Retrieval (EWR) area (northwest side), and in Trenches 32 and 58.

The south end of Pit 16 was pumped all day Sunday (2-21-82). By Sunday afternoon the water level was below the M-III bins.

On Monday morning (2-22-82), Pit 16 still had water in the north end, 1 to 2-ft deep in the area where the FY 1981 rock removal program was performed. Only small puddles were found in the remainder of the SDA. These puddles were small enough that pumping was not feasible. It appeared that one more day of pumping would be required to complete the water removal from the SDA.

At about 1000 hours, the RWMC Health Physics Supervisor requested that Pit 16 pumping be stopped. A review of the water sample log had revealed that the beta-gamma count rate of the water samples was increasing, indicating a possible problem. The pumping was stopped until further analysis could be performed. Water samples were taken and sent to Exxon Nuclear for detailed isotope identification.

Following the 2-22-82 hold, no further pumping was performed. By February 26, the water level in the north end of Pit 16 had lowered an additional 6 in. due to evaporation and soaking into the ground. All of the water in the remainder of the SDA had also soaked into the ground or evaporated.

Access restrictions into the SDA were maintained until the full effects of subsidence could be identified. On March 30, 1982, a detailed walking inspection of the SDA was made to establish the areas of subsidence. They were located by pacing the distance from the nearest monument to the start of the subsidence and then pacing the length of the subsidence. The results of this visual examination were documented and are summarized in Table 1.

#### ANALYSIS AND FOLLOW-UP ACTIONS

Water samples taken during the recovery operations following the dike failure showed that only one sample exceeded DOE 5480.1, Chapter XI limits for releases to an uncontrolled area. This sample, taken February 23, 1982 from Pit 16, contained  $2.2 \times 10^{-6}$   $\mu\text{Ci/mL}$  Sr-90 activity. The uncontrolled limit for Sr-90 is  $3 \times 10^{-7}$   $\mu\text{Ci/mL}$  for a continuous release. The DOE-ID Order 5480.1 Chapter XII allows effluent discharges to be averaged over one month. When averaged over the pumping period (5 days) the Sr-90 uncontrolled area limits were not exceeded. In addition, the above sample was taken on February 23, 1982 and pumping was discontinued on

February 22, 1982 so this water did not leave the RWMC. Some of the water samples also indicated RA-226 was present in concentrations above the DOE uncontrolled limits. These data are considered unreliable due to the presence of a high and variable radium daughter background at the laboratories where the analyses was done. Also, this isotope is naturally occurring and high background levels have been seen previously at the RWMC area.

Unusual Occurrence Report RWMC-82-1 (Reference 3) has been generated documenting the excessive run-off water in and around the RWMC.

Following the completion of the recovery operations, soil samples were taken from the RWMC drainage channel. The samples were taken and analyzed by RWMC Health Physics personnel. Appendix II of this report contains a discussion and the results of the soil samples. None of the samples exceeded the RWMC administrative guideline of 0.1 nCi/g.

OBSERVATIONS MADE AND LESSONS LEARNED

1. Water samples averaged over the pumping period 2-17-82 to 2-22-82 indicate that the water released from the RWMC did not exceed the established DOE limits for release to an uncontrolled area.
2. During periods when excessive run-off could be a problem, an experienced dedicated watch should be posted 24 hr per day.
3. A complete drainage assessment of the RWMC needs to be performed, and drainage channels and dikes improved or modified as noted.
4. A berm system around the open pit area should be established and maintained.
5. The height of the soil cap over closed trenches in the east end of the SDA needs to be raised.
6. An organized plan for emergency water sampling should be set up. This plan should include guidelines for rapidly evaluating samples, guidelines for determining when and where isotopic concentrations will be determined, and predetermined administrative limits for gross activity and concentrations.
7. The RWMC Radiation Analysis Laboratory (RAL) needs to be set up to more quickly handle water sampling.
8. The INEL is inadequately equipped with large volume flow rate pumps. the new pumps that are available are not dependable.
9. Separate data sheets should be maintained for each area being monitored.

## REFERENCES

1. DOE Directive 5480.1, Chapter XI, Requirements for Radiation Protection, April 29, 1981.
2. Unusual Occurrence Report EG&G-82-10, Contamination of Personnel Clothing, RWMC-82-2, March 1, 1982.
3. Unusual Occurrence Report EG&G-82-8, Fast Spring Surface Run-off Allowing Excess Water In and Around the RWMC, RWMC-82-1, February 22, 1982.

TABLE 1. RESULTS OF THE VISUAL INSPECTION OF THE SDA PERFORMED ON  
MARCH 30, 1982(1)

Location	Description
Trench 32	30 yards of subsidence starting 10 yards from the east monument approximately 2 ft deep.
Pit 14	25 yards of subsidence starting 50 yards from the north monument approximately 3 ft deep.  100 yards of subsidence starting 20 yards from the south monument approximately 3 ft deep. Numerous land bridges where subsidence extends below the access road.
Trench 30	40 yards of subsidence starting 10 yards from the west monument approximately 3 ft deep.
Trench 42 (3)	25 yards of subsidence starting at the east monument approximately 3 ft deep.  50 yards of subsidence starting 30 yards from the west monument approximately 1.5 ft deep. A drainage hole <sup>a</sup> was found 60 yards from the west monument.
Trench 49 (4)	150 yards of subsidence starting at the east monument approximately 2 ft deep. A drainage hole <sup>a</sup> was found 1 yard from the east monument.
Trench 51 (3)	70 yards of subsidence starting at the east monument approximately 3 ft deep. A drainage hole <sup>a</sup> was found 60 yards from the east monument.
Trench 40	10 yards of subsidence starting 50 yards from the east monument approximately 3 ft deep.
Trench 13	1 yard of subsidence starting 10 yards from the east monument approximate 1 ft deep.
Trench 58	15 yards of subsidence starting 10 yards from the east monument approximately 3.5 ft deep.
EWR	Subsidence pit on east side approximately 20 ft in diameter and 3.5 ft deep.

TABLE 1. (continued)

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NOTES

1. T. P. Zahn letter to J. D. Wells, March Visual Inspection, TPZ-3-82, April 5, 1982.
2. Measurements are approximations made by pacing.
3. This trench contained a drainage hole.<sup>a</sup> The EG&G Bioscience Branch poured a concentrated dye (Rhodamine-WT) into the hole to monitor water migration.
4. This trench contained a drainage hole<sup>a</sup> in the east end. Concentrated dye was not put into this drainage hole since it had filled with water.

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a. A drainage hole is where water was found flowing into the trench.

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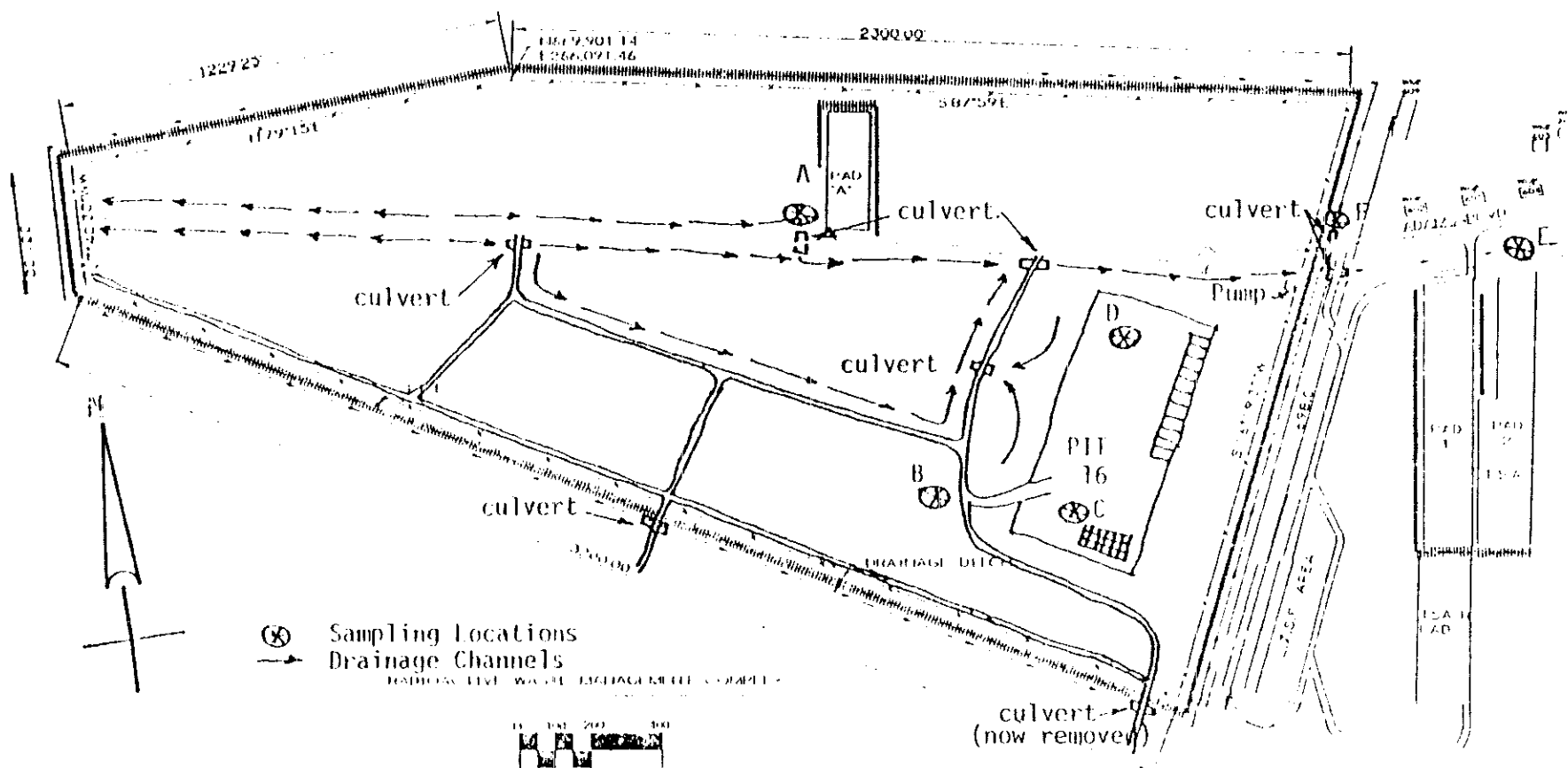


Figure 1: The RWMC SDA Showing Major Drainage Channels, Features, and Water Sample Points.

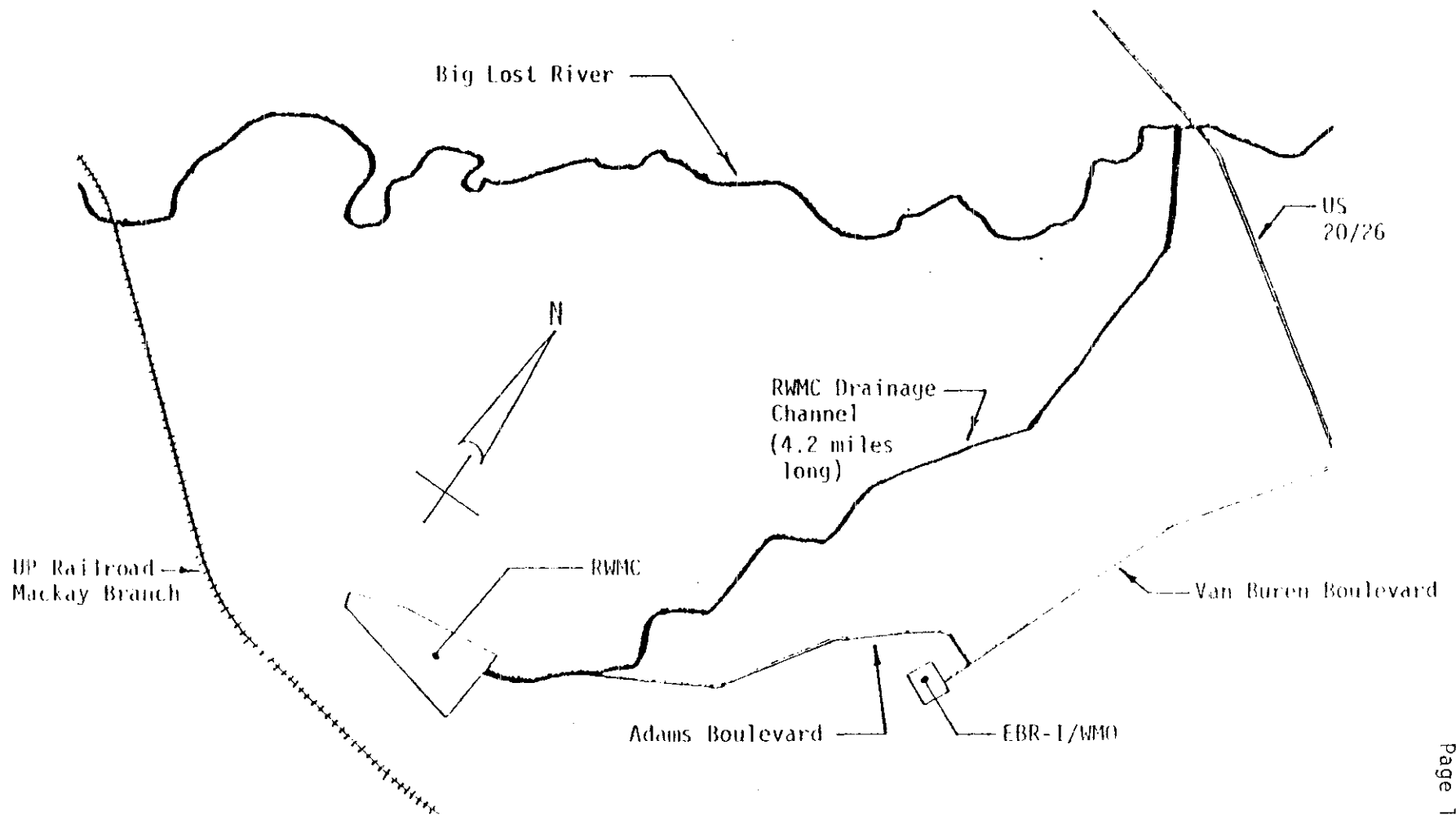


Figure 2: The RWMC Drainage Channel and its Relationship to the Big Lost River.

## APPENDIX I

### WATER SAMPLING AT THE RWMC

Following the discovery of a dike failure on February 17, 1981, a water-sampling program was initiated. The purpose of the sample program was to verify and document that the water being released from the RWMC met the requirements of DOE Directive 5480.1 (Reference I-1) for release to an uncontrolled area. | 1

Water samples were taken by three groups: RWMC Health Physics personnel, EG&G Waste Programs Environmental Science Section, and DOE Radiological and Environmental Sciences Laboratory (RESL).

Analysis of water samples was done by four organizations; the RWMC Radiation Analysis Laboratory (RAL), Exxon Nuclear Idaho Company (ENICO), RESL, and the Radiation Measurements Laboratory (RML) at the Test Reactor Area (TRA).

The results of the analysis are presented in Tables I-1, I-2, and I-3. Table I-1 contains the results of samples taken from the north end of Pit 16. Table I-2 contains the results of samples taken from the south end of Pit 16. Table I-3 contains the results of samples taken from various locations in and around the RWMC. | 1

The majority of water samples were analyzed by the RML and the RAL. The sample collection, preparation, and analysis techniques were identical for these facilities. The isotopic concentration was determined by taking a 500-mL sample and analyzing it using gamma-ray spectrometry techniques. Each sample was counted for two hours (7200 sec). Table I-4 shows the estimated detection limits for the RML. The detection limits for the RAL are similar. | 1

The gross activity of a water sample analyzed by the RWMC is determined by taking a 10-mL sample and evaporating it in a drying oven. The prepared sample is then counted for 10 min in an alpha/beta proportional counter. The background activity is subtracted from the gross activity to determine the corrected net activity.

Some of the water samples were sent to ENICO for evaluation (Reference I-3). These samples were four liter samples that had 15-mL of concentrated nitric acid added to them to help keep the radionuclides in solution. When the sample was received by ENICO, one liter was removed as a backup sample. The remaining three liters were slowly boiled to reduce the volume to about one liter. The sample was then set aside to allow the suspended solids to settle. After about one day of settling, the water was siphoned off and saved. The remaining solution was filtered. The filtered water and the siphoned water was placed in a one liter Marinelli beaker, and clean water was added to obtain a one liter sample. The solid material was encapsulated in a 50-mL counting vial. The counting vial and the Marinelli beaker was analyzed using gamma-ray spectrometry techniques. The liquid sample was further reduced in volume to 50-mL. A 1-mL sample was taken from the reduced sample and dried under a heat lamp. The dried sample was then counted for beta and alpha activity.

RESL sampled water that had left the RWMC. Their water samples consisted of 1000-mL samples acidified with 2% nitric acid. At RESL, the water sample was separated into three samples. A 400-mL sample was removed for gamma-ray spectrometry analysis. The gross beta activity was determined from a 10-mL water sample. The sample was evaporated in a drying oven, and the dried sample was counted for 20 min. The gross alpha activity was determined from a 5-mL water sample. The water was evaporated in a drying oven, and the dried sample is counted for 60 min. Background activity was subtracted from the gross activities to determine the corrected beta and alpha activities.

During the recovery operations, a quick means of screening samples was required. The alpha/beta proportional counter at the RWMC seemed to be the answer. Water samples could be screened easily and quickly to determine trends and to determine which samples required further analysis. Since no guidelines for water sampling at the RWMC existed, the 20 cpm above background guideline for surface contamination was used. A 10-mL water sample was used since it approximates the area covered during a smear survey, the beta/gamma efficiency of the proportional counter is 10 percent, and a 10-mL sample could be prepared quickly. The 20 cpm/10-mL sample represents a beta/gamma concentration of  $9.01\text{E-}6$   $\mu\text{Ci/mL}$ . The guideline that has been established for waterborne releases from the RWMC is  $3\text{E-}6$   $\mu\text{Ci/mL}$ . This value corresponds to 6.7 cpm/10-mL sample. Subsequent water sampling at the RWMC will use 6.7 cpm/10-mL as a guideline for screening the samples. If a water sample exceeds 6.7 cpm/10-mL operations will be suspended, if possible, and a gamma scan performed to determine the radionuclide content and concentration. If the gamma scan shows that no release limits are being exceeded, operations will be resumed using the new count rate as a guideline.

The water sample results show that no water left the RWMC that exceeded the limits for waterborne release to an uncontrolled area as defined in DOE Directive 5480.1 (Reference I-1). Pumping was stopped on February 22, 1982.

#### REFERENCES

- I-1. DOE Directive 5480.1, Chapter XI, Requirements for Radiation Protection, April 29, 1981.
- I-2. J. W. Rogers letter to L. O. Miller, JWR-7-82, RWMC Water Samples 2-18-82, February 19, 1982.
- I-3. Appendix B, RWMC Environmental Handbook, PR-W-80-015.

TABLE I-1. RESULTS OF WATER SAMPLES TAKEN FROM THE NORTH END OF PIT 16

Date	Time	Location (Analyzer)	Activity (6)		Isotope	Gamma Scan (10)	
			Alpha (cpm)	Beta/Gamma (cpm)		Activity ( $\mu\text{Ci/mL}$ )	Guide (5) ( $\mu\text{Ci/mL}$ )
2-17	1330	Pit 16--North (7)	0.3	1.9	(1)	(1)	N/A
2-17	1800	Pit 16--North (7)	0.2	0	(1)	(1)	N/A
2-17	2100	Pit 16--North (7)	0.2	0	(1)	(1)	N/A
2-18	0100	Pit 16--North (7)	0.1	0	(1)	(1)	N/A
2-18	0500	Pit 16--North (7)	0.2	0	(1)	(1)	N/A
2-18	0900	Pit 16--North (7)	0.1	0	(1)	(1)	N/A
2-18	1300	Pit 16--North (7)	0.1	0	(2)	(2)	N/A
2-18	1330	Pit 16--North (8)	(2)	(2)	Cs-137	4( $\pm 2$ )E-7	2E-5
2-18	(4)	Pit 16--North (9)	<5E-9 (3)	1.3( $\pm 0.03$ )E-6(3)	Co-60	2.2( $\pm 0.3$ )E-9	5E-5
					Cs-134	1.7( $\pm 0.08$ )E-8	9E-6
					Cs-137	2.4( $\pm 0.04$ )E-7	2E-5
					Ra-226	7.9( $\pm 0.7$ )E-9	3E-8
2-18	1530	Pit 16--North (8)	0.1	0	(2)	(2)	N/A
2-19	1100	Pit 16--North (8)	0	8.5	(2)	(2)	N/A
2-19	1300	Pit 16--North (8)	(2)	(2)	(1)	(1)	N/A
2-19	1300	Pit 16--North (8)	(2)	(2)	Cs-137	5.9( $\pm 3.0$ )E-7	2E-5

TABLE I-1. (continued)

Date	Time	Location (Analyzer)	Activity (6)		Gamma Scan (10)		
			Alpha (cpm)	Beta/Gamma (cpm)	Isotope	Activity ( $\mu\text{Ci/mL}$ )	Guide (5) ( $\mu\text{Ci/mL}$ )
2-19	(4)	Pit 16--North (9)	<8E-9 (3)	2.6( $\pm 0.05$ )E-6(3)	Co-60 Cs-134 Cs-137	6.3( $\pm 0.6$ )E-9 3.2( $\pm 0.1$ )E-8 4.2( $\pm 0.06$ )E-7	5E-5 9E-6 2E-5
2-19	1600	Pit 16--North (8)	0	9.4	(1)	(1)	N/A
2-19	1600	Pit 16--North (8)	(2)	(2)	(1)	(1)	N/A
2-19	2000	Pit 16--North (8)	0	17.6	Cs-137	1.0( $\pm 0.5$ )E-6	2E-5
2-19	2330	Pit 16--North (8)	(2)	(2)	Cs-137	1.1( $\pm 0.6$ )E-7	2E-5
2-19	2400	Pit 16--North (8)	0.1	23.4	Cs-137	6.4( $\pm 3.2$ )E-7	2E-5
2.20	0200	Pit 16--North (8)	0.4	16.9	Ru-103 Cs-134 Cs-137 Ra-226	3.6( $\pm 1.4$ )E-6 1.3( $\pm 0.5$ )E-7 1.2( $\pm 0.6$ )E-6 2.6E-7 (11)	8E-5 9E-6 2E-5 3E-8
2-21	2200	Pit 16--North (8)	0	15.9	(2)	(2)	N/A
2-21	2400	Pit 16--North (8)	0	20.3	Ru-103 Rh-106 Cs-134 Cs-137 Ra-226 Th-228	2.2( $\pm 0.9$ )E-6 3.8( $\pm 1.9$ )E-7 2.8( $\pm 1.1$ )E-7 3.4( $\pm 1.7$ )E-6 2.5E-7 (11) 1.0E-6 (11)	8E-5 3E-6 9E-6 2E-5 3E-8 7E-6

TABLE I-1. (continued)

Date	Time	Location (Analyzer)	Activity (6)		Isotope	Gamma Scan (10)	
			Alpha (cpm)	Beta/Gamma (cpm)		Activity ( $\mu\text{Ci/mL}$ )	Guide (5) ( $\mu\text{Ci/mL}$ )
2-22	0200	Pit 16--North (8)	0	26.1	(2)	(2)	N/A
2-22	0400	Pit 16--North (8)	0	27.6	Cs-134 Cs-137	3.8( $\pm 1.5$ )E-7 3.5( $\pm 1.8$ )E-6	9E-6 2E-5
2-22	0600	Pit 16--North (8)	0	28.9	Cs-134 Cs-137	3.5( $\pm 1.4$ )E-7 2.4( $\pm 1.2$ )E-6	9E-6 2E-5
2-22	0800	Pit 16--North (8)	0	27.4	Co-60 Cs-134 Cs-137	<9.7E-8 2.8( $\pm 1.1$ )E-7 2.8( $\pm 1.4$ )E-6	5E-5 9E-6 2E-5
2-22	1100	Pit 16--North (8)	(2)	(2)	Rh-106 Cs-134 Cs-137 Th-228	3.8( $\pm 1.9$ )E-7 2.6( $\pm 1.0$ )E-7 2.4( $\pm 1.2$ )E-6 1.0E-6 (11)	3E-6 9E-6 2E-5 7E-6
2-22	(4)	Pit 16--North (9)	<1E-8 (3)	6.6( $\pm 0.2$ )E-6 (3)	Co-60 Cs-134 Cs-137 Ru-106	2.2( $\pm 0.3$ )E-8 2.3( $\pm 0.09$ )E-7 2.0( $\pm 0.03$ )E-6 9.9( $\pm 2.1$ )E-8	5E-6 9E-6 2E-5 1E-5
2-23	(4)	Pit 16--North (9)	<1E-8 (3)	5.6( $\pm 0.08$ )E-6 (3)	Ce-144 Co-60 Cs-134 Cs-137 Ra-226 Ru-106	2.8( $\pm 0.7$ )E-8 2.3( $\pm 0.1$ )E-8 1.1( $\pm 0.02$ )E-7 1.1( $\pm 0.01$ )E-6 3.4( $\pm 0.9$ )E-9 9.5( $\pm 0.3$ )E-8	1E-5 5E-5 9E-6 2E-5 3E-8 1E-5

TABLE I-1. (continued)

Date	Time	Location (Analyzer)	Activity (6)		Isotope	Gamma Scan (10)	
			Alpha (cpm)	Beta/Gamma (cpm)		Activity ( $\mu\text{Ci/mL}$ )	Guide (5) ( $\mu\text{Ci/mL}$ )
2-24	1600	Pit 16--North (8)	(2)	(2)	Cs-134	$3.3(\pm 1.3)\text{E-}7$	$9\text{E-}6$
					Cs-137	$3.4(\pm 1.7)\text{E-}6$	$2\text{E-}5$
3-1	1400	Pit 16--North (8)	(2)	(2)	Co-60	$<7.9\text{E-}8$	$5\text{E-}5$
					Ru-106	$<3.3\text{E-}7$	$1\text{E-}5$
					Cs-137	$3.5(\pm 1.8)\text{E-}7$	$2\text{E-}5$
					Th-228	$<9.0\text{E-}7$	$7\text{E-}6$

## NOTES:

1. None detected
2. Not measured
3.  $\mu\text{Ci/mL}$
4. Not noted
5. Guide concentration for release to an uncontrolled area (DOE 5480.1)
6. Net activity corrected for background
7. Counted by RWMC, scanned by the RML
8. Analyzed by RWMC HP personnel
9. Analyzed by Exxon Nuclear Idaho
10. The results are the sum of the liquid and solid activities
11. No uncertainty values available for these isotopes.

TABLE I-2. RESULTS OF WATER SAMPLES TAKEN FROM THE SOUTH END OF PIT 16

Date	Time	Location (Analyzer)	Activity (6)		Isotope	Gamma Scan (10)	
			Alpha (cpm)	Beta/Gamma (cpm)		Activity ( $\mu\text{Ci/mL}$ )	Guide (5) ( $\mu\text{Ci/mL}$ )
2-17	1330	Pit 16--South (7)	0.3	0	(1)	(1)	N/A
2-18	1300	Pit 16--South (8)	0.2	0	(2)	(2)	N/A
2-18	1330	Pit 16--South (8)	(2)	(2)	(1)	(1)	N/A
2-18	(4)	Pit 16--South (9)	<3E-9 (3)	<3E-9 (3)	(1)	(1)	N/A
2-18	1530	Pit 16--South (8)	0.2	0	(2)	(2)	N/A
2-19	0930	Pit 16--South (8)	0	2.3	(2)	(2)	N/A
2-19	1100	Pit 16--South (8)	0.2	0.1	(2)	(2)	N/A
2-19	(4)	Pit 16--South (9)	<3E-9 (3)	8( $\pm$ 3)E-9 (3)	Ra-226	8.0( $\pm$ 5.6)E-9	3E-8
2-19	1600	Pit 16--South (8)	0	0	(2)	(2)	N/A
2-19	2000	Pit 16--South (8)	0.2	0.6	(1)	(1)	N/A
2-19	2330	Pit 16--South (8)	(2)	(2)	(1)	(1)	N/A
2-19	2400	Pit 16--South (8)	0.3	0	Ra-226	1.9E-7 (11)	3E-8
2-20	0200	Pit 16--South (8)	0.5	0	(1)	(1)	N/A
2-20	0400	Pit 16--South (8)	0.1	0	Cs-134 Cs-137	1.5( $\pm$ 0.6)E-7 5.0( $\pm$ 2.5)E-7	9E-6 2E-5

TABLE I-2. (continued)

Date	Time	Location (Analyzer)	Activity (6)		Isotope	Gamma Scan (10)	
			Alpha (cpm)	Beta/Gamma (cpm)		Activity ( $\mu\text{Ci/mL}$ )	Guide (5) ( $\mu\text{Ci/mL}$ )
2-20	0600	Pit 16--South (8)	0.1	3.7	(1)	(1)	N/A
2-20	0800	Pit 16--South (8)	0	0	(1)	(1)	N/A
2-20	1000	Pit 16--South (8)	0	0	Rh-106 Th-228	3.5( $\pm 1.8$ )E-7 9.4E-7 (11)	3E-6 7E-6
2-20	1200	Pit 16--South (8)	(2)	(2)	Th-228	7.5E-8 (11)	7E-6
2-22	(4)	Pit 16--South (9)	2.7( $\pm 0.8$ ) E-9 (3)	2.2( $\pm 0.1$ )E-8 (3)	Cs-137 Ra-226	8.9( $\pm 0.8$ )E-9 1.3( $\pm 0.2$ )E-9	2E-5 3E-8

## Notes:

1. None detected
2. Not measured
3.  $\mu\text{Ci/mL}$
4. Not noted
5. Guide concentration for release to an uncontrolled area (DOE 5480.1)
6. Net activity corrected for background
7. Counted by RWMC, scanned by the RML
8. Analyzed by RWMC HP personnel
9. Analyzed by Exxon Nuclear Idaho
10. The results are the sum of the liquid and solid activities
11. No uncertainty values available for these isotopes.

TABLE I-3. RESULTS OF WATER SAMPLES TAKEN FROM VARIOUS LOCATIONS IN AND AROUND THE RWMC

Date	Time	Location (Analyzer)	Activity (6)		Isotope	Gamma Scan (10)		Guide (5) ( $\mu\text{Ci/mL}$ )	
			Alpha (cpm)	Beta/Gamma (cpm)		Activity ( $\mu\text{Ci/mL}$ )			
2-16	(4)	TSA Ditch (10)	<2E-9 (3)	1.4( $\pm 0.5$ )E-8 (3)	Ra-226	2.2( $\pm 0.1$ )E-8		3E-8	
2-16	(4)	SDA Ditch (10)	1.1( $\pm 0.5$ )E-8 (3)	8.5( $\pm 0.2$ )E-7 (3)	Cs-134	3.6( $\pm 0.04$ )E-7		9E-6	1
					Cs-137	8.0( $\pm 0.08$ )E-7		2E-5	
2-16	(4)	TDA (10)	<2E-9 (3)	<5E-9 (3)	(1)	(1)		N/A	
2-16	(4)	Pit 16--NE side-- next to boxes (10)	<2E-9 (3)	8( $\pm 3$ )E-9 (3)	Ra-226	1.4( $\pm 0.08$ )E-8		3E-8	1
2-16	(4)	SDA--south--near HV-11 (10)	<8E-9 (3)	2( $\pm 1$ )E-8 (3)	Ra-226	7.3( $\pm 0.5$ )E-8		3E-8	1
2-16	(4)	Big Lost River (10)	<5E-9 (3)	<1E-8 (3)	Ra-226	6.1( $\pm 0.06$ )E-7		3E-8	1
2-17	1330	Pit 16--Middle (8)	0.2	0	(1)	(1)		N/A	
2-17	1504	Adams Blvd., 1/2 mi east RWMC (11)	0	0	Cs-137	1.1( $\pm 1.2$ )E-8		2E-5	
2-18	0920	Adams Blvd., 1/2 mi east RWMC (11)	0	0	Cs-137	1.8( $\pm 1.9$ )E-8		2E-5	
2-18	1330	Pit 16--NE side-- next to boxes (9)	(2)	(2)	Cs-137	9.6( $\pm 4.8$ )E-7		2E-5	1
2-18	1530	Adams Blvd., 1/2 mi east RWMC (11)	0	0	Cs-137	1.9( $\pm 3.8$ )E-8		2E-5	
					K-40	6.5( $\pm 3.2$ )E-7		3E-6	
2-19	0903	Adams Blvd., 1/2 mi east RWMC (11)	0	0	Bi-214	8.6( $\pm 6.4$ )E-8		(7)	
					Cs-137	1.6( $\pm 1.6$ )E-8		2E-5	

TABLE I-3. (continued)

Date	Time	Location (Analyzer)	Activity (6)		Isotope	Gamma Scan (10)	
			Alpha (cpm)	Beta/Gamma (cpm)		Activity ( $\mu\text{Ci/mL}$ )	Guide (5) ( $\mu\text{Ci/mL}$ )
2-19	1610	Adams Blvd., 1/2 mi east RWMC (11)	0	5.3	Cs-137 Sr-90	1.2( $\pm 4.8$ )E-7 2.1( $\pm 0.5$ )E-7	2E-5 3E-7
2-23	(4)	Pit 16 (10)	<1E-8 (3)	6.6( $\pm 0.2$ )E-6 (3)	Sr-90 Co-60 Cs-134 Cs-137 Ru-106 Ra-226	2.2( $\pm 0.07$ )E-6 2.2( $\pm 0.3$ )E-8 2.6( $\pm 0.9$ )E-7 2.4( $\pm 0.03$ )E-6 9.9( $\pm 2.1$ )E-8 6.2( $\pm 0.1$ )E-7	3E-7 5E-5 9E-6 2E-5 1E-5 3E-8
2-23	(4)	SDA---SE corner (10)	<2E-9 (3)	1.6( $\pm 0.5$ )E-8 (3)	Ra-226	3.7( $\pm 0.05$ )E-7	3E-8
2-23	(4)	Big Lost River (10)	1.4( $\pm 0.6$ )E-9 (3)	1.1( $\pm 0.1$ )E-8 (3)	Ra-226	3.3( $\pm 0.05$ )E-7	3E-8
2-24	1500	Pit 16---silt from	(2)	(2)	K-40 Cs-134 Cs-137 Ra-226 Th-228	1.6E-5 (13) 3.1( $\pm 1.2$ )E-6 3.2( $\pm 1.6$ )E-5 1.4E-6 (13) 1.6E-6 (13)	3E-6 9E-6 2E-5 3E-8 7E-6
2-26	1300	Drain channel--- south of WMF 602 (9)	0	7.8	Ru-106 Cs-137 Th-228	3.0( $\pm 1.5$ )E-7 2.9( $\pm 1.2$ )E-7 <8.1E-7	1E-5 2E-5 7E-6
2-26	1330	Drain channel--- 2 mi NE of RWMC (9)	0.1	1.4	(1)	(1)	N/A

TABLE I-3. (continued)

<u>Date</u>	<u>Time</u>	<u>Location (Analyzer)</u>	<u>Activity (6)</u>		<u>Isotope</u>	<u>Gamma Scan (10)</u>	
			<u>Alpha (cpm)</u>	<u>Beta/Gamma (cpm)</u>		<u>Activity (<math>\mu</math>Ci/mL)</u>	<u>Guide (5) (<math>\mu</math>Ci/mL)</u>

## NOTES:

1. None detected
2. Not measured
3.  $\mu$ Ci/mL
4. Not noted
5. Guide concentration for release to uncontrolled area (DOE 5480.1)
6. Net activity corrected for background
7. Not applicable guide concentration listed
8. Counted by RWMC, scanned by RML
9. Analyzed by RWMC HP personnel
10. Analyzed by Exxon Nuclear Idaho
11. Analyzed by RESL
12. The results are the sum of the liquid and solid activities
13. No uncertainties available for these isotopes.

TABLE I-4. THE ESTIMATED DETECTION LIMITS OF THE RML

<u>ISOTOPE</u>	<u>DETECTION LIMIT (<math>\mu\text{Ci/mL}</math>)</u>
Na-24	3.0 E-7
Sc-46	1.1 E-7
Cr-51	4.3 E-7
Mn-54	6.0 E-8
Fe-59	2.0 E-7
Co-58	8.5 E-8
Co-60	2.0 E-7
Zn-65	9.0 E-8
Sr-91	6.0 E-7
Zr-95	2.0 E-7
Nb-95	5.0 E-8
Ru-103	9.0 E-8
Rh-106	5.0 E-7
Agm-110	1.0 E-7
Sb-124	5.0 E-7
Sb-125	9.0 E-7
I-131	6.0 E-7
Cs-134	6.5 E-8
Cs-137	1.1 E-7
Ba-140	1.5 E-7
La-140	2.0 E-7
Ce-141	7.0 E-8
Ce-144	3.0 E-7
Pr-144	7.6 E-6
Eu-152	2.0 E-7
Eu-154	3.0 E-7
Hf-181	1.0 E-7
Hg-203	8.0 E-8
Np-239	2.0 E-7
Am-241	3.5 E-7

## APPENDIX II

### SOIL SAMPLING AT THE RWMC

Following the completion of recovery operations, soil samples were taken from the RWMC drainage channel. These channels were taken to verify that the activity of the soil was within the RWMC administrative limit of 1.0 nCi/g. Table II-1 contains the results of the RWMC draining channel soil samples. A review of Table II-1 shows that none of the samples exceed the administrative limit on the administrative guideline.

The RWMC uses 1.0 nCi/g as an administrative limit and 0.1 nCi/g as an administrative guideline. These values are administrative only since no standards currently exist for soil activities.

The soil samples were taken from the RWMC drainage channel by RWMC Health Physics personnel. The typical sample was 500 g. At the RWMC Health Physics facility a smaller sample (approximately 15g) for counting was taken from the larger sample. The smaller sample was weighed and then counted in an alpha/beta proportional counter. The results of the soil samples are contained in Table II-1.

TABLE II-1. (Continued)

Date	Sample (grams)	Activity (1) (2)			
		Beta/Gamma		Alpha	
		cpm	nCi/g	cpm	nCi/g

## NOTES:

1. Corrected for background
2. An administrative limit of 1 nCi/g was used to evaluate samples
3. Estimated weight. The actual weight was not recorded.

UNUSUAL OCCURRENCE REPORT  
EG&G IDAHO, INC.

Page 1 of 3

1. UOR Number EG&G-82-8  
Facility Number RWMC-82-1

2. Status and Date: x Initial 2-22-82  
Interim  
x Final 9-17-82

3. Division or Project:  
Radioactive Waste Management Complex (RWMC)

4. Facility, System and/or Equipment: 5. Date of Occurrence: 6. Time of Occurrence:  
Radioactive Waste Management Complex 16-17 February 1982 Between 2000 hours 2-16-82  
and 0800 hours 2-17-82

7. Subject:

A break in the flood control dike during spring runoff allowed water to enter the waste disposal pit. The runoff water contacted the lower waste containers.

8. Apparent Cause: Design        Material        Personnel        Procedure x  
Other        (explain in Item 14)

9. Description of Occurrence:

Following above average precipitation and very cold temperatures, a quick thaw, aided by wind, rain, frozen ground and above normal temperatures produced a condition where excessive surface water ran off faster than normal. Runoff water flowed around the administrative area up to the thresholds of buildings WMF 601, 602 and 604; however, no water entered the buildings. The dike around the Subsurface Disposal Area (SDA) perimeter was restricting outside runoff from entering the SDA. Snow melt from within was causing some ponding; however, no water had entered the main pit or was in contact with the disposed waste.

At the close of the extended workday, on Tuesday February 16, 1982, water levels were receding and the last RWMC Operations personnel left the facility at 2015 hours following an inspection tour to ensure that the runoff water was draining undisturbed. Upon arriving at the facility, at approximately 0800 hours on Wednesday, the following conditions were discovered:

1. Water had receded from the administrative area.
2. The dike at the southeast corner of the SDA was breached, eroded about six inches below the top of the dike, allowing runoff water to enter the SDA.
3. Much of the east portion of the SDA was covered with water.

9. Description of Occurrence (cont.):

4. Pits 16, 17, and 18 were partly filled with the water that flowed into the SDA. Water levels reached approximately 18 inches up on the bottom row of boxed waste in the north end of the pits and approximately four feet up on the bottom row of the six foot high M-III bins in the south end of the pits.

10. Operating Condition of Facility at the Time of Occurrence:

Normal operations

11. Immediate Evaluation:

Ice and snow had blocked the culverts running under the road at the southeast corner of the SDA causing the level in the drainage canal to raise and overflow the dike. A portion of the dike eroded approximately six inches down allowing runoff water to flow into the SDA.

12. Immediate Action Taken and Results:

Several actions were immediately taken to begin recovery. They included:

1. A temporary repair was made to the breached dike and the area where water was entering the pits.
2. The southeast access road and culverts were completely removed to allow free flow of water.
3. CFA Equipment Pool, Labor Pool, the EG&G Fire Engineering and the DOE Fire Department were contacted for pumps.
4. Samples were taken and analyzed for contamination in excess of uncontrolled release limits.
5. WP-RWMC Operations Manager and DOE-ID were notified.

Pumps began to arrive at approximately 1500 hours on February 17, 1982; one 3" pump worked and two 2" pumps did not work. An excess fire pump was located at approximately 1400 hrs. on February 17, 1982; but due to repairs and modifications required to refurbish the pump, it was not placed in service until February 19, 1982. A 6" pump located at Raft River arrived at the RWMC at approximately 2200 hrs. on February 17, 1982. Prior to pumping, water samples were taken of the pit water and analyzed for radioactive contamination. Results showed the water was well within limits allowed for discharge to an uncontrolled area. Water sampling continued on a periodic basis during the entire pumping operation. Pumping was conducted on a three shift per day basis.

3. Is Further Evaluation and/or Corrective Action Necessary? Yes x No    

If yes, before further operations? Yes     No x

If yes, by whom?

WP-RWMC Operations

The break in the dike at the southeast corner of the SDA was repaired and the dike height at the southwest corner of the pit area dike was raised.

## 14. Final Evaluation and Lessons Learned:

The final evaluation is reported in detail in the Engineering Design File (EDF) Number 103, "Failure of a Dike and Entry of Runoff Water Into the RWMC SDA - 1982," Rev. 1. The report documents the events that resulted in runoff water entering the SDA and the corrective actions to mitigate the immediate consequences of the water entering the SDA. It also notes the long term corrective action needed, and that a dedicated, experienced 24 hour per day watch be posted whenever similar high runoff conditions exist.

15. Corrective Action: Taken x\*\* Recommended        To be supplied \*\*

The break in the southeast corner dike was repaired, the dike at the southwest corner of the pit area was raised and the standing water was removed from the SDA.

A Construction Project Request (CPR), Number 09-RWMC-90, was issued for improvements of RWMC drainage channels and dikes as noted in a complete drainage assessment of the RWMC.

Revision of Project Directive 1.1 - "WP-RWMC Operations Branch Manager, Tech. Support Supervisor, and RWMC Supervisor Reposnsibilities" has been revised to require posting a 24 hour watch during periods of high runoff potential.

\*\*[Near term corrective action (dike repair, drainage channel and dike improvement and procedural change) has been completed. Long term corrective action requirements are identified and will be corrected upon completion of CPR 09-RWMC-90.]

## 16. Programmatic Impact:

RWMC SDA waste handling was stopped until necessary repairs were completed.

## 17. Impact Codes and Standards:

None

## 18. Similar Unusual Occurrence Report Numbers:

No UOR's; however, flooding from runoff occurred in 1962 and 1969 as noted in PR-W-79-038, "A History of the Radioactive Waste Management Complex at the Idaho National Engineering Laboratory." The flooding conditions and subsequent actions are described in References 12 and 13 of that document.

## 19. Signatures:

Originator:

*J. D. Wells*  
J. D. Wells

Date

21 Sept 1982

Reviewed By

*K. P. Lange*  
(Branch Manager) K. P. Lange

Date

9-12-82

Reviewed By

*K. C. Carroll*  
(Quality Division) K. C. Carroll

Date

9-27-82

Reviewed By

*D. K. Chandler*  
(Safety Division) D. K. Chandler

Date

9-28-82

Approved By

*P. H. Beers*  
Organization Manager - P. H. Beers  
Division Level or Above

Date